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PENDING CLAIMS

1. (Original): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of tubular coil electrodes on an exterior portion of the distal shaft section, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section, being positioned so that the temperature sensor is disposed between two adjacent electrodes;

d) a metal band adjacent to and radially disposed about an outer surface of the temperature sensor and shaft; and

e) one or more electrical conductors electrically connected to the at least one temperature sensor, at least partially embedded and helically disposed within a wall of the elongated shaft.

2. (Original): The device of claim 1 further including a plurality of electrode electrical conductors which are each electrically connected to an individual electrode at a distal end of the electrode electrical conductor and having a proximal end configured to connect to an electrical source.

3. (Original): The device of claim 2 wherein the shaft has an elongated core member disposed therein.

4. (Original): The device of claim 3 further including a jacket disposed about the core member.

5. (Original): The device of claim 4 having the electrode electrical conductors at least in part helically braided into the core member jacket.

6. (Original): The device of claim 5 having the electrode electrical conductors at least in part helically braided into the shaft.

7. (Original): The device of claim 3 further including a distal tip member secured to the distal end of the shaft.

8. (Original): The device of claim 7 wherein the distal tip member includes a coil member disposed about a distal extremity of the core member distal to the shaft.

9. (Original): The device of claim 2 wherein the shaft has a lumen extending therein configured to slidably receive a guidewire therein.

10. (Original): The device of claim 2 wherein the electrode electrical conductors are helically braided into the shaft.

11. (Original): The device of claim 1 further including a jacket disposed on and about the metal band.

12. (Original): The device of claim11 wherein the jacket is in part disposed about a periphery of the two electrodes adjacent to the temperature sensor.

13. (Original): The device of claim 4 wherein the jacket is disposed about and in contact with the metal band, and defines an outer surface of the electrophysiology device.

14. (Original): The device of claim1 wherein the jacket is in part disposed about a periphery of at least one of the two electrodes adjacent to the temperature sensor.

15. (Original): The device of claim 1 wherein the electrodes are sensing and ablation electrodes.

16. (Original): The device of claim 1 wherein the distal shaft section has a maximum outer dimension less than 1.65 mm.

17. (Original): The device of claim 1 wherein the metal band is soldered to the temperature sensor.

18. (Original): An electrophysiology device assembly, comprising:

a) a guiding member having an elongated shaft having a proximal end, a distal end, a port in the proximal end, a port in a distal shaft section, and a lumen extending therein; and

b) an electrophysiology device slidably disposed in the lumen of the guiding member, comprising:

an elongated shaft having a proximal end, a distal end, and a distal shaft section, and a plurality of electrical conductors helically braided into the shaft;

a plurality of tubular coil electrodes on an exterior portion of the distal shaft section electrically connected to the electrical conductors, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

a plurality of temperature sensors on an exterior portion of the distal shaft section, being positioned so that at least one temperature sensor is disposed between two adjacent electrodes, each temperature sensor being electrically connected to at least one of the electrical conductors helically braided into the shaft; and

a plurality of metal bands on the shaft, so that a metal band is adjacent to and radially disposed about an outer surface of each temperature sensor

and the shaft.

19. (Original): The assembly of claim 18 wherein the guiding member distal shaft section is shapeable.

20. (Original): A method for treating a patient, comprising:

a) providing an electrophysiology device, comprising:

an elongated shaft having a proximal end, a distal end, and a distal shaft section, and a plurality of electrical conductors helically braided into the shaft;

a plurality of tubular coil electrodes on an exterior portion of the distal shaft section electrically connected to the electrical conductors, having an interelectrode spacing of about 1 mm to not greater than 3 mm; and

a plurality of temperature sensors on an exterior portion of the distal shaft section, being positioned so that at least one temperature sensor is disposed between two adjacent electrodes, each temperature sensor being electrically connected to at least one of the electrical conductors helically braided into the shaft; and

a plurality of metal bands on the shaft, so that a metal band is adjacent to and radially disposed about an outer surface of each temperature sensor and the shaft;

b) introducing the device into the patient's vasculature and advancing the device until the distal section of the device is disposed within a chamber of the patient's heart;

c) placing at least one electrode on the device distal shaft section in contact with a desired surface of the heart chamber; and

d) delivering high frequency electrical energy to the at least one

electrode on the device and measuring the temperature at a temperature sensor adjacent the electrode.

21. (Original): The method of claim 20 further including before step (a), providing an elongated guiding member having proximal and distal ends, an inner lumen extending therein to the distal end configured to slidably receive the electrophysiology device, and a port on a distal section in communication with the inner lumen, and introducing the guiding member into the patient's vasculature and advancing the distal end of the guiding member to a chamber of the patient's heart.

22. (Original): The method of claim 20 wherein the patient is treated for heart fibrillation or flutter.

23. (Original): The method of claim 20 including placing at least two adjacent electrodes on the device distal shaft section in contact with a desired surface of the heart chamber, and delivering high frequency electrical energy to the two adjacent electrodes on the device, and measuring the temperature at a temperature sensor between the two electrodes, to form a first lesion and a second lesion continuous with the first lesion on the surface of the heart chamber.

24. (Original): An electrophysiology device for use within a patient's heart, comprising:

a) an elongated shaft having proximal and distal ends; and

b) a distal shaft section including a plurality of longitudinally disposed tubular coil electrodes on an exterior portion thereof, the electrodes having a maximum outer diameter of about 1 mm to about 1.22 mm and a length of about 2 mm to about 8 mm and an interelectrode spacing of about 1 mm to not greater than 3 mm, at least one

temperature sensor disposed on an exterior portion of the distal shaft section between two adjacent electrodes, and a plurality of individually insulated electrical conductors at least partially embedded and helically disposed within a wall of the elongated shaft each electrode and the at least one temperature sensor being electrically connected to at least one electrical conductor.

25. (Original): The electrophysiology device of claim 24 including an inner lumen extending within the elongated shaft, configured to slidably receive a device therein.

26. (Original): The electrophysiology device of claim 24 including a core member extending within the elongated shaft.

27. (Original): The electrophysiology device of claim 26 wherein the electrical conductors are disposed about the core member.

28. (Original): The electrophysiology device of claim 24 wherein the electrical conductors form at least part of a wall of the distal shaft section.

29. (Original): The electrophysiology device of claim 24 including a source of high frequency electrical energy electrically connected to the electrical conductors.

30. (Amended): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of electrodes on an exterior portion of the distal shaft section; and

c) a plurality of temperature sensors on an exterior portion of the distal shaft

section, being positioned so that at least one temperature sensor is disposed between two adjacent electrodes, and each temperature sensor having a conducting member comprising an annular metal band radially disposed about and adjacent to the shaft and the temperature sensor thereon, which [transmits heat] facilitates detecting tissue temperature adjacent to conducting member connected to the temperature sensor, and a jacket radially disposed on and about an outer surface of the metal band configured to insulate the temperature sensor from electrical interference from adjacent electrodes.

31. (Amended): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of electrodes on an exterior portion of the distal shaft section;

c) at least one temperature sensor on an exterior portion of the distal shaft section, being positioned so that the temperature sensor is disposed between two adjacent electrodes;

d) a conducting member connected to the temperature sensor which is configured to facilitate detecting tissue temperature adjacent to the conducting member connected to the temperature to the sensor; and

e) a jacket disposed about the conducting member and a periphery of at least one of the two electrodes adjacent to the temperature sensor which is configured to insulate the temperature sensor from electrical interference from adjacent tissue.

32. (Amended): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of electrodes on an exterior portion of the distal shaft section;

c) at least one temperature sensor on an exterior portion of the distal shaft section, being positioned so that the temperature sensor is disposed between two adjacent electrodes; and

d) a jacket which is disposed about the at least one temperature sensor and in part disposed about a periphery of the two electrodes adjacent to the at least one temperature sensor and which is configured to insulate the temperature sensor from electrical interference from the adjacent electrodes.

33. (Original): The device of claim 32 wherein the jacket is an electrically insulating material.

33. (Original): The device of claim 32 wherein the jacket is an electrically insulating material.

34. (Original): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of tubular coil electrodes on an exterior portion of the distal shaft section having an interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section, being positioned so that the temperature sensor is disposed between two adjacent electrodes;

d) one or more electrical conductors electrically connected to the at least one temperature sensor, at least partially embedded and helically disposed within a wall of the elongated shaft.

35. (Original): An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of tubular coil electrodes on an exterior portion of the distal shaft section, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section, being positioned so that the temperature sensor is disposed between two adjacent electrodes;

d) a conducting member disposed about an outer surface of the temperature sensor; and

e) one or more electrical conductors electrically connected to the at least one temperature sensor, at least partially embedded and helically disposed within a wall of the elongated shaft.

36. (Twice Amended) An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section with a proximal portion and a distal portion;

b) a plurality of electrodes on the proximal portion of the distal shaft section, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section disposed between two adjacent electrodes and having a conductive metallic band disposed over and connected to the sensor that is configured to insulate the temperature sensor from electrical interference from the adjacent electrodes;

d) an elongated core member in the distal shaft section.

37. (Pending) The electrophysiology device of claim 36 wherein the distal portion of the distal shaft section is electrode free.

38. (Pending) The electrophysiology device of claim 36 wherein the distal portion of the distal shaft section is formed at least in part of a helical coil.

39. (Pending) The electrophysiology device of claim 38 wherein the helical coil is embedded in a polymeric material.

40. (Pending) The electrophysiology device of claim 36 wherein the distal shaft section has a core member extending therein.

41. (Pending) The electrophysiology device of claim 40 wherein the core member is formed of a material selected from the group consisting of stainless steel and NiTi alloy.

42. (Pending) The electrophysiology device of claim 41 wherein the NiTi alloy exhibits superelasticity.

43. (Pending) The electrophysiology device of claim 42 wherein the NiTi alloy has a stable austenite phase at body temperature.

44. (Pending) The electrophysiology device of claim 43 wherein the NiTi alloy exhibits stress induced austenite-to-martensite phase transformation.

45. (Pending) The electrophysiology device of claim 40 wherein the core member has a distal end secured to the coil in the distal portion thereof.

46. (Pending) The electrophysiology device of claim 36 further including a plurality of electrode electrical conductors which are each electrically connected to an individual electrode at a distal end of the electrode electrical conductor and having a proximal end configured to connect to an electrical source.

47. (Pending) The electrophysiology device of claim 36 wherein the shaft has an inner lumen and the elongated core member is disposed therein.

48. (Pending) The device of claim 47 further including a jacket disposed about the core member.

49. (Pending) The device of claim 46 having the electrode electrical conductors at least in part helically braided into the core member jacket.

50. (Pending) The device of claim 46 having the electrode electrical conductors at least in part helically braided into the shaft.

51. (Pending) The device of claim 36 further including a distal tip member secured to the distal end of the shaft.

52. (Pending) The device of claim 51 wherein the distal tip member includes a coil member disposed about a distal extremity of the core member distal to the shaft.

53. (Cancelled)

54. (Pending) The device of claim 36 wherein the metal band is soldered to the temperature sensor.

55. (Pending) The device of claim 36 wherein a jacket is disposed about and in contact with the metal band, and defines an outer surface of the electrophysiology device.

56. (Pending) The device of claim 55 wherein the jacket covers part of an adjacent electrode.

57. (Pending) The device of claim 55 wherein the jacket covers part of both electrodes adjacent to the temperature sensor.

58. (Pending) The device of claim 55 wherein the jacket covers a periphery of at least one of the two electrodes adjacent to the temperature sensor.

59. (Pending) The device of claim 36 wherein at least some of the electrodes are sensing and ablation electrodes.

60. (Pending) The device of claim 36 wherein the distal shaft section has a maximum outer dimension less than 1.65 mm.

61. (Twice Amended) An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, a distal shaft section with a proximal portion and a distal portion and a wall portion defining at least in part an inner lumen extending within the distal shaft section;

b) an elongated core member disposed within the inner lumen;

c) a plurality of electrodes on the proximal portion of the distal shaft section, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

d) a plurality of electrical conductors which are at least partially embedded within a wall of the elongated shaft, and which have distal ends electrically connected to an electrode on the proximal shaft portion; and

e) at least one temperature sensor on an exterior portion of the distal shaft section which is disposed between two adjacent electrodes and ~~having~~ which has a conductive metallic band disposed over and connected to the sensor that is configured to tissue facilitate detecting temperature adjacent to the band connected to the temperature sensor.

62. (Twice Amended) An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, a distal shaft section with a proximal portion and a distal portion and a wall portion defining at least in part an inner lumen extending within the distal shaft section;

b) a plurality of electrodes on the proximal portion of the distal shaft section, having an interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section disposed between two adjacent electrodes and having a conductive metallic band disposed over and connected to the sensor which is configured to facilitate detection of tissue temperature adjacent to the band connected to the sensor; and

d) at least one electrical conductor which is at least partially embedded within a wall of the elongated shaft, and which has a distal end electrically connected to the at least one temperature sensor on the proximal shaft portion.

63. (Twice Amended) An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, a distal shaft section with a proximal portion and a distal portion and a wall portion defining at least in part an inner lumen extending within the distal shaft section;

b) a plurality of partially covered electrodes on the proximal portion of the distal shaft section;

c) at least one temperature sensor on an exterior portion of the distal shaft section disposed between two adjacent electrodes and having a conductive metal band disposed over and connected to the at least one temperature sensor which is configured to facilitate detection of tissue temperature adjacent to the band connected tissue to the temperature sensor;

d) at least one electrical conductor which has a distal end electrically connected to the at least one temperature sensor on the proximal shaft portion; and

e) a core member disposed in the distal shaft section.

64. (Pending) The electrophysiology device of claim 48 wherein the core member is formed of a material selected from the group consisting of stainless steel and NiTi alloy.

65. (Pending) The electrophysiology device of claim 64 wherein the NiTi alloy exhibits superelasticity.

66. (Pending) The electrophysiology device of claim 65 wherein the NiTi alloy has a stable austenite phase at body temperature.

67. (Pending) The electrophysiology device of claim 66 wherein the NiTi alloy exhibits stress induced austenite-to-martensite phase transformation.

68. (Twice Amended) A method for treating a patient, comprising:

a) the step of providing an electrophysiology device, comprising:

an elongated shaft having a proximal end, a distal end, and a distal shaft section, and a plurality of electrical conductors;

a plurality of electrodes on an exterior portion of the distal shaft section electrically connected to the electrical conductors, having an interelectrode spacing of not more than about 3 mm;

a plurality of temperature sensors on an exterior portion of the distal shaft section, being positioned so that at least one temperature sensor is disposed between two adjacent electrodes, each temperature sensor being electrically connected to at least one of the electrical conductors and having a conductive metallic band disposed over and connected to the sensor which is configured to facilitate

detection of tissue temperature adjacent to the band connected to the temperature sensor;

b) the step of introducing the device into the patient's vasculature and advancing the device until the distal section of the device is disposed at a desired location;

c) the step of positioning the device within a location of the patient's vasculature where one or more electrodes are in contact with a desired surface within the vasculature;

d) the step of delivering high frequency electrical energy to the one or more electrodes in contact with the desired surface to ablate tissue; and

e) the step of detecting electrical activity with one or more of the electrodes after tissue ablation to determine the effectiveness of the tissue ablation.

69. (Twice Amended) The method of claim 68 wherein high frequency electrical energy is directed to the electrodes sequentially in a proximal direction.

70. (Twice Amended) An electrophysiology device for forming a continuous lesion in a patient's heart tissue, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section;

b) a plurality of partially covered electrodes on a proximal portion of the distal shaft section, with each electrode having a length of about 2 to about 8 mm and interelectrode spacing of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor disposed between two adjacent electrodes and having a conductive metallic band disposed over and connected to the sensor which is configured to facilitate detection of tissue temperature adjacent to the band connected to the temperature sensor; and

d) one or more electrical conductors electrically connected to the at least one temperature sensor.

71. (Twice Amended) A method of treating a patient for cardiac arrhythmia by electrically isolating a first tissue region from a second tissue region, comprising:

a) providing an electrophysiology device having an elongated shaft which has a proximal end, a distal shaft section having a proximal portion with a plurality of electrodes with temperature sensors between adjacent electrodes having conductive metal bands disposed over and connected to the sensors which are configured to facilitate detection of tissue temperature adjacent to the bands connected to the temperature sensors and having a distal portion with a distal end;

b) positioning the proximal portion of the distal shaft section at a desired location between the first tissue region and the second tissue region; and

c) ablating a continuous lesion pattern between the first and second tissue regions with the electrodes on the proximal portion of the distal shaft section to electrically isolate the two tissue regions.

72. (Pending) The method of claim 71 wherein an electrode is provided on the distal end of the distal portion of the distal shaft section.

73. (Twice Amended) An electrophysiology device for treating cardiac arrhythmia by electrically isolating a first tissue region from a second tissue region, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section with a proximal portion and a distal portion;

b) a plurality of electrodes on the proximal portion of the distal shaft section, having an interelectrode spacing not greater than 3 mm;

c) at least one temperature sensor on the distal shaft section disposed between two adjacent electrodes and having a conductive metallic band extending over and connected to the sensor which is configured to facilitate detection of tissue temperature adjacent to the band connected to the temperature sensor; and

d) a core member extending at least within the distal shaft section formed of a material selected from the group consisting of stainless steel and a NiTi alloy.

74. (Pending) The electrophysiology device of claim 73 wherein the NiTi alloy exhibits superelasticity.

75. (Pending) The electrophysiology device of claim 73 wherein the NiTi alloy has a stable austenite phase at body temperature.

76. (Pending) The electrophysiology device of claim 73 wherein the NiTi alloy exhibits stress induced austenite-to-martensite phase transformation.

77. (Twice Amended) An electrophysiology device, comprising:

a) an elongated shaft having a proximal end, a distal end, and a distal shaft section with a proximal portion and a distal portion;

b) a plurality of electrode means for ablation on the proximal portion of the distal shaft section, having a spacing between electrode means of about 1 mm to not greater than 3 mm;

c) at least one temperature sensor on an exterior portion of the distal shaft section disposed between two adjacent electrode means and having a conductive metallic band disposed over and connected to the sensor which is configured to facilitate detection of tissue temperature adjacent to the band connected to the temperature sensor; and

d) an elongated core member in the distal shaft section.